LOWER ARKANSAS RIVER BASIN TOTAL MAXIMUM DAILY LOAD

Water Body: Cheney Lake
Water Quality Impairment: Eutrophication

Subbasin: North Fork Ninnescah

County: Reno, Stafford, Pratt, Kingman, and Sedgwick

HUC 8: 11030014

HUC 11 (HUC 14)**:** **010** (030, 040, 050, 060, 070, 080, 090)
020 (010, 020, 030, 040, 050)
030 (010, 020, 030, 040, 050)

Drainage Area: Approximately 880.6 square miles. **(Figure 1)**

Conservation Pool: Area = 7,663 acres, Maximum Depth = 13 meters

Designated Uses: Primary and Secondary Contact Recreation; Expected Aquatic Life Support; Drinking Water; Industrial Water Supply Use; Food Procurement

1998 303d Listing: Table 4 - Water Quality Limited Lakes

Impaired Use: All uses are impaired to a degree by eutrophication

Water Quality Standard: Nutrients - Narrative: The introduction of plant nutrients into streams, lakes, or wetlands from artificial sources shall be controlled to prevent the accelerated succession or replacement of aquatic biota or the production of undesirable quantities or kinds of aquatic life. (KAR 28-16-28e(c)(2)(B)).

The introduction of plant nutrients into surface waters designated for primary or secondary contact recreational use shall be controlled to prevent the development of objectionable concentrations of algae or algal by-products or nuisance growths of submersed, floating, or emergent aquatic vegetation. (KAR 28-16-28e(c)(7)(A)).

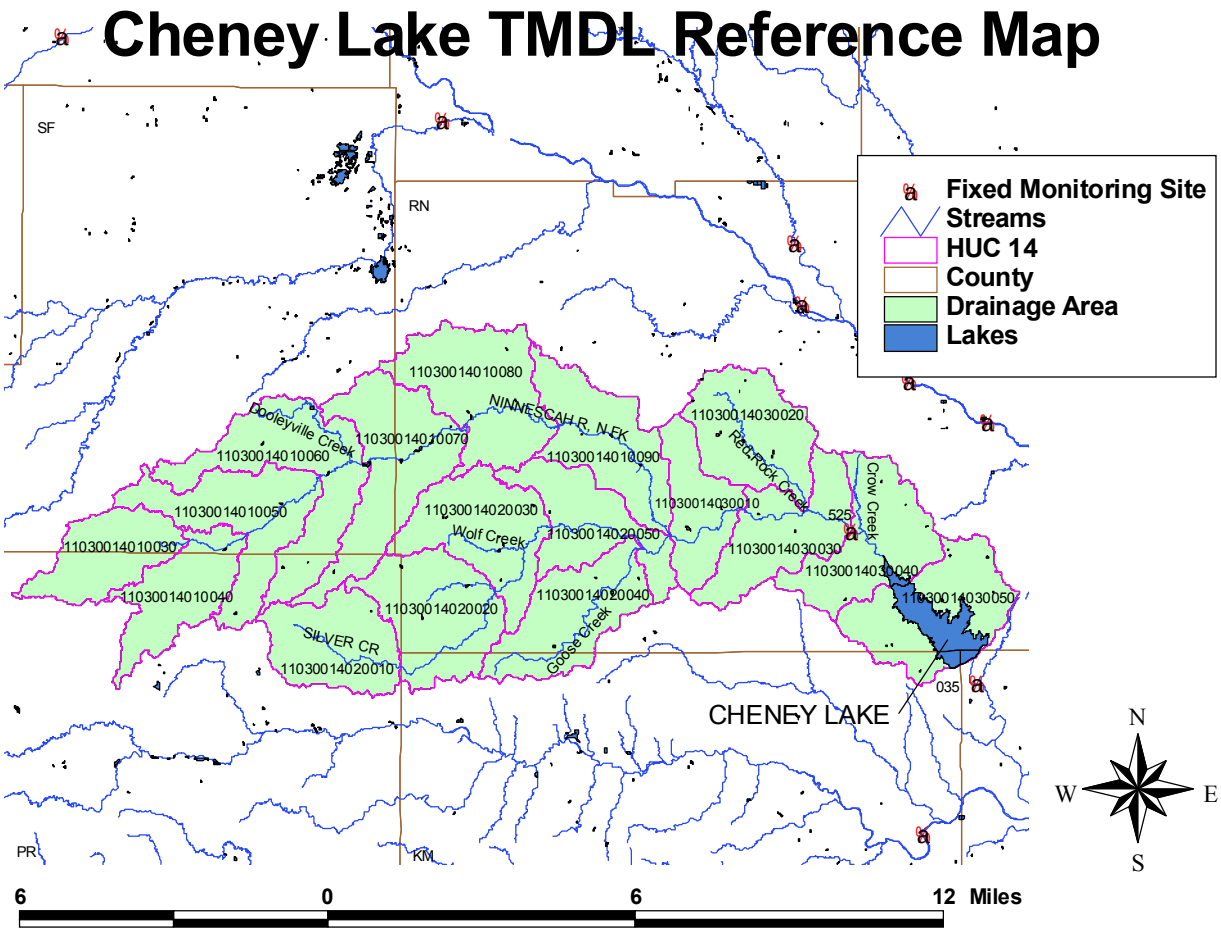

Figure 1

2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

Level of Eutrophication: Mesotrophic, Trophic State Index = 42.63

Monitoring Sites: Station 017001 in Cheney Lake.

Period of Record Used: Eight surveys during 1975-1999. Special 319 Project.
Four year study (1996 - 2000) conducted by the US Geological Survey

Current Condition: Cheney Lake has chlorophyll a concentrations averaging 3.42 ppb. This relates to a Trophic State Index of 42.63, indicating mesotrophic conditions. The chlorophyll a

concentration has increased over time. The average concentration was 1.98 ppb in 1987 and rose to 6.10 ppb by 1999.

The Trophic State Index is derived from the chlorophyll a concentration. Trophic state assessments of potential algal productivity were made based on chlorophyll a concentrations, nutrient levels and values of the Carlson Trophic State Index (TSI). Generally, some degree of eutrophic conditions is seen with chlorophyll a concentrations over 12 ug/l and hypereutrophy occurs at levels over 30 ug/l. The Carlson TSI, derives from the chlorophyll concentrations and scales the trophic state as follows:

1. Oligotrophic	TSI < 40
2. Mesotrophic	TSI: 40 - 49.99
3. Slightly Eutrophic	TSI: 50 - 54.99
4. Fully Eutrophic	TSI: 55 - 59.99
5. Very Eutrophic	TSI: 60 - 63.99
6. Hypereutrophic	TSI: ≥ 64

Sampling done by KDHE showed elevated total phosphorus concentrations (averaging 117 ppb). Seventy-one percent of the samples are over 100 ppb. Light is indicated to be the primary limiting factor. Surface water in Cheney Lake has high turbidity, dominated by inorganic materials. (The lake is very open to the wind and sediment resuspension is evident). Co-limitation between phosphorus and nitrogen would be likely if the light limitation were removed.

Results of a US Geological Survey report indicate higher concentrations of total phosphorus. The average phosphorus concentration was 190 ppb; only one of their thirty-four monitoring sites had total phosphorus concentrations below 100 ppb. Much of the phosphorus coming into Cheney Lake is in sediment, mainly on finer particles. The phosphorus concentrations in sediment (averaging 450 mg/kg) are increasing over time. The concentrations are especially high near the dam (710 mg/kg) as compared to near the upper end of the lake (94 mg/kg).

Problems related to water supply appear to occur in a specific sequence. First, after a period of calm weather in the summer, the top 1-2 meters of water clear up significantly. Second, an algal bloom results, typically of the species *Microcystis aeruginosa*. Third, severe taste and odor problems result in finished water. A portion of this taste and odor problem in the past has been the chemical additions before the water leaves for Wichita. This acts to release all the geosmin from algae cells before the water reaches the treatment plant, overwhelming the process.

Interim Endpoints of Water Quality (Implied Load Capacity) at Cheney Lake over 2005 - 2010:

In order to prevent further degradation of the lake, the desired endpoint will be to maintain summer chlorophyll a concentrations at or below 6 ug/l. Refined endpoints will be developed in 2005 to reflect additional sampling and artificial source assessment and confirmation of impaired status of lake.

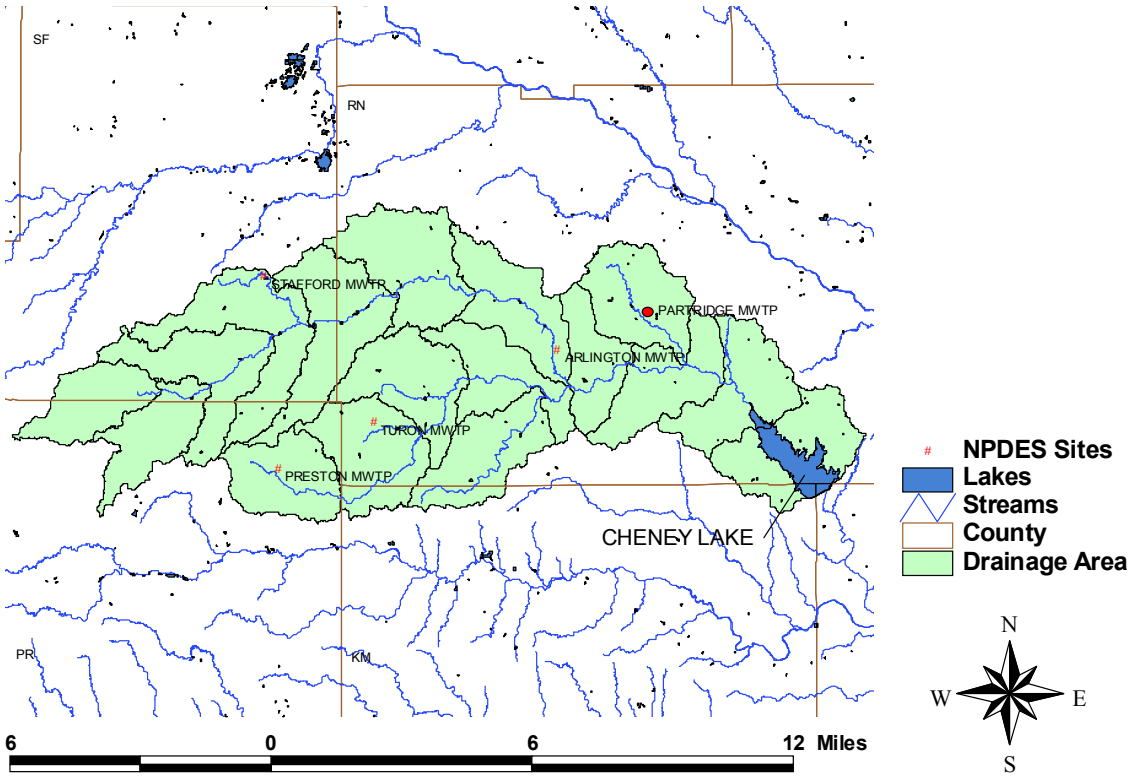

Figure 2

3. SOURCE INVENTORY AND ASSESSMENT

NPDES: Five NPDES permitted facilities are located within the watershed. Four (Stafford, Arlington, Partridge, and Turon MWTP) have discharging, waste stabilization ponds. Preston MWTP has a single stage, trickling filter system. According to projections of future water use and resulting wastewater, Stafford MWTP does not look to have sufficient treatment capacity available. Given the limited design flow of this lagoon system, this municipal point source may impact the watershed. These point sources contribute an estimated 2% of total annual phosphorus loads. **(Figure 2)**

Name	Stream	Design Flow	Predicted Population Change in 2020
Arlington MWTP	Unnamed Stream	0.081	No Change
Partridge MWTP	Red Rock Creek	0.031	- 18.8%
Preston MWTP	Silver Creek	0.05	- 12.0%
Stafford MWTP	Doolyville Creek	0.145	- 10.7%
Turon MWTP	Unnamed Stream	0.065	7.7%

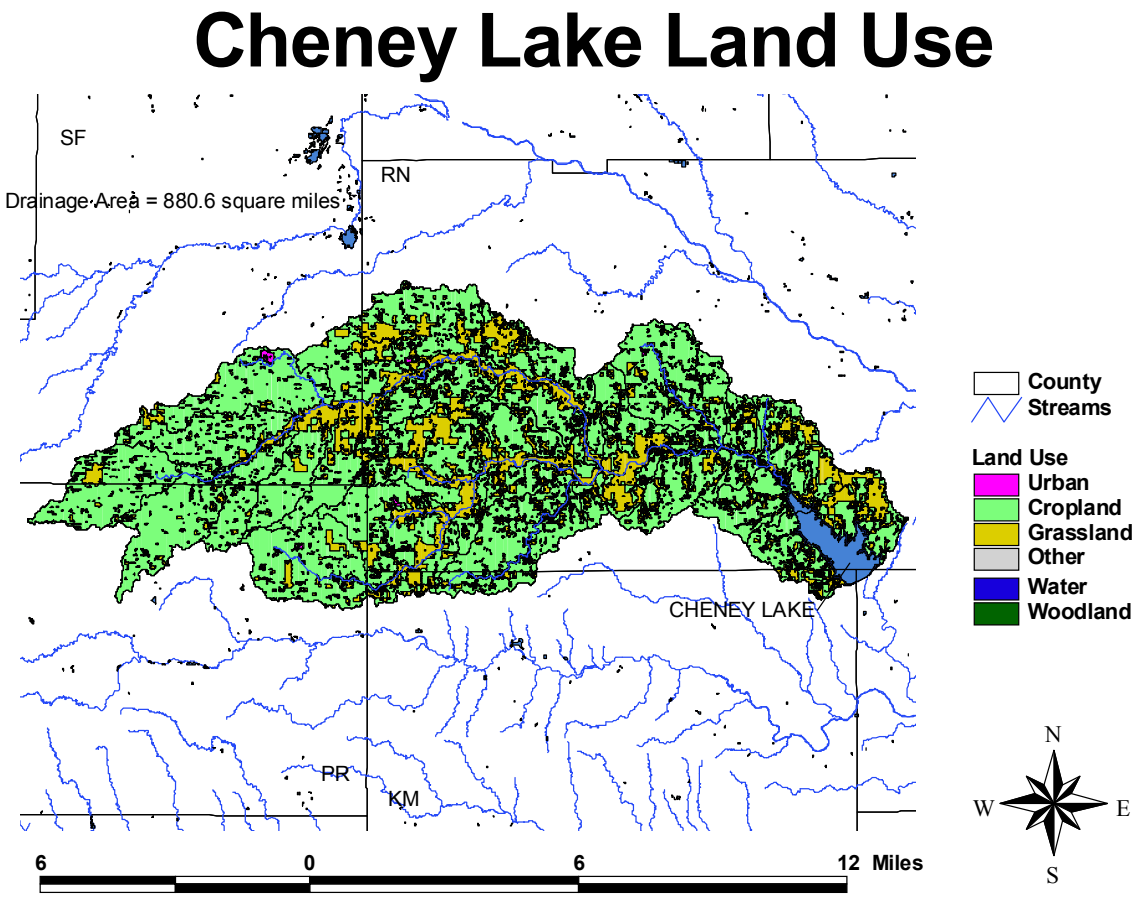

Figure 3

Land Use: The watershed around Cheney Lake has a high potential for nonpoint source pollutants. An annual phosphorus load of 213,846 pounds per year is necessary to correspond to the concentrations seen in the lake. **(Figure 3)**

The primary source of phosphorus within Cheney Lake is probably runoff from agricultural lands where phosphorus has been applied. Land use coverage analysis indicates that 72.6% of the watershed is cropland. In 1998, the total amount of fertilizer sold in Reno, Stafford, Pratt, and Kingman Counties was 143,634 tons. Assuming that the drainage area of Cheney Lake covers 24.2 percent of the counties, then 34,759 tons of fertilizer were bought and potentially used with the watershed.

Phosphorus from animal waste is a contributing factor. Twenty-four percent of land around the lake is grassland; the grazing density of livestock is average. Animal waste, from confined animal feeding operations, adds to the nitrogen and phosphorus load going into Cheney Lake. There are 22 dairy, 17 beef, and 4 swine animal feeding operations in the watershed. Potential animal units for all facilities in the watershed total 47,082. The actual number of animal units on site is variable, but typically less than potential numbers.

A potential pollutant is septic systems located around the lake. The largest towns in the watershed are Arlington, Castleton, Partridge, Preston, Stafford, Sylvia, and Turon.

Contributing Runoff: The watershed has an average soil permeability of 5.1 inches/hour according to NRCS STATSGO data base. Runoff would be produced from storms one to two hours in duration, having a recurrence interval up to twenty five years and storms of three hours in duration, having a recurrence interval of twenty-five years. Runoff is chiefly generated as infiltration excess with rainfall intensities greater than soil permeabilities. Generally, 13 percent of the watershed would generate runoff under dryer conditions or smaller storms. Moderate or wet conditions or larger storms would see runoff contributed from most of the watershed .

Background Levels: Nutrient recycling from the sediments in the lake is likely contributing available phosphorus to the lake for algal uptake. Geological formations contain small amounts of phosphorus (up to 0.5% of total weight), and may contribute to phosphorus loads.

4. ALLOCATION OF POLLUTANT REDUCTION RESPONSIBILITY

More detailed assessment of sources and confirmation of the trophic state of the lake must be completed before detailed allocations can be made. The general inventory of sources within the drainage does provide some guidance as to areas of load reduction.

Point Sources: This impairment is partially associated with municipal waste treatment plants. Ongoing inspections and monitoring of these NPDES sites will be made to ascertain the contributions that have been made by these sources. The Wasteload Allocation should be at 2,352 pounds per year, a decrease of 45 percent, which should result in a decrease in available phosphorus.

Cheney Lake CAFOs Sites

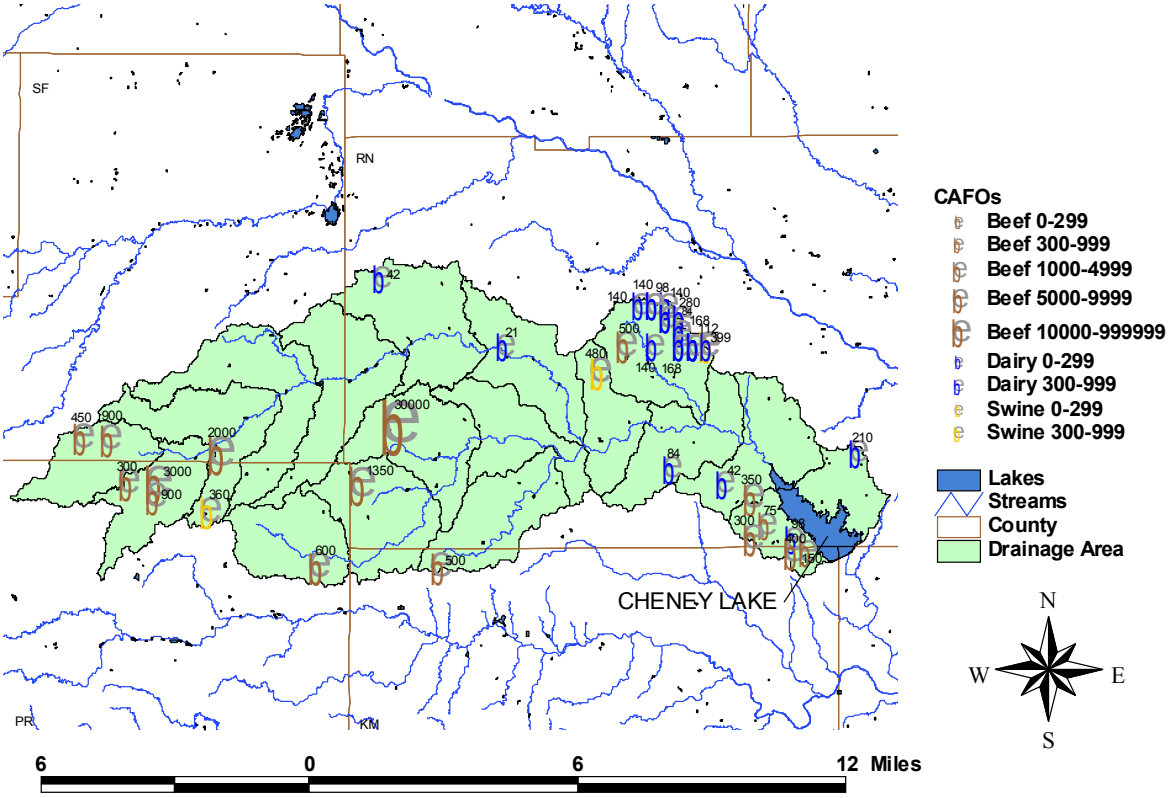

Figure 4

Nonpoint Sources: Water quality violations are predominantly due to nonpoint source pollutants. Background levels may be attributed to nutrient recycling. The assessment suggests that cropland and animal waste contribute to the elevated phosphorus concentrations in the lake. Generally a Load Allocation of 103,501 pounds per year, leading to a 45% reduction in available phosphorus is necessary to reach the endpoint.

Defined Margin of Safety: The margin of safety provides some hedge against the uncertainty of variable annual total phosphorus loads and the chlorophyll a endpoint. Therefore, the margin of safety will be 11,762 pounds per year of total phosphorus taken from the load capacity to ensure that adequate load reduction occurs to meet the endpoint.

State Water Plan Implementation Priority: Because Cheney Lake is a federal reservoir with a large regional benefit for recreation and water supply, this TMDL will be a High Priority for implementation.

Unified Watershed Assessment Priority Ranking: This watershed lies within the North Fork Ninnescah (HUC 8: 11030014) with a priority ranking of 7 (High Priority for restoration).

Priority HUC 11s: The watershed is within HUC 11s (010, 020, 030).

5. IMPLEMENTATION

Desired Implementation Activities

There is a very good potential that agricultural best management practices will allow full use support to take place in Cheney Lake. Many of these best management practices are currently being put into practice through the local, 319 lake protection project. Despite such potential improvements, turbidity may still remain a problem due to the wind-mixed conditions. Some of the recommended agricultural practices are as follows:

1. Implement soil sampling to recommend appropriate fertilizer applications on cropland.
2. Maintain conservation tillage and contour farming to minimize cropland erosion.
3. Install grass buffer strips along streams.
4. Reduce activities within riparian areas.
5. Implement nutrient management plans to manage manure application to land.

Implementation Programs Guidance

NPDES-KDHE

a. Begin to evaluate nutrient loading from municipal dischargers in the watershed.
b. Work with those dischargers on reducing their individual loadings.

Nonpoint Source Pollution Technical Assistance - KDHE

a. Support Section 319 demonstration projects for reduction of sediment runoff from agricultural activities as well as nutrient management.
b. Provide technical assistance on practices geared to establishment of vegetative buffer strips.
c. Provide technical assistance on nutrient management in vicinity of streams.

Water Resource Cost Share Program - SCC

a. Apply conservation farming practices, including terraces and waterways, sediment control basins, and constructed wetlands.

Nonpoint Source Pollution Control Program - SCC

a. Provide sediment control practices to minimize erosion and sediment and nutrient transport.

Riparian Protection Program - SCC

a. Establish or reestablish natural riparian systems, including vegetative filter strips and streambank vegetation.
b. Develop riparian restoration projects.
c. Promote wetland construction to assimilate nutrient loadings.

Buffer Initiative Program - SCC

a. Install grass buffer strips near streams.
b. Leverage Conservation Reserve Enhancement Program to hold riparian land out of production.

Extension Outreach and Technical Assistance - Kansas State University

a. Educate agricultural producers on sediment, nutrient, and pasture management.
b. Educate livestock producers on livestock waste management and manure applications and nutrient management planning.
c. Provide technical assistance on livestock waste management systems and nutrient management plans.
d. Provide technical assistance on buffer strip design and minimizing cropland runoff.
e. Encourage annual soil testing to determine capacity of field to hold phosphorus.

Time Frame for Implementation: Pollutant reduction practices should be installed within the priority subwatersheds during the years 2001-2005, with minor follow up implementation, including other subwatersheds over 2005-2009.

Targeted Participants: Primary participants for implementation will be agricultural producers within the drainage of the lake. Initial work in 2005 should include local assessments by conservation district personnel and county extension agents to locate within the lake drainage:

1. Total row crop acreage
2. Cultivation alongside lake
3. Drainage alongside or through animal feeding lots
4. Livestock use of riparian areas
5. Fields with manure applications

Milestone for 2005: The year 2005 marks the midpoint of the ten-year implementation window for the watershed. At that point in time, sampled data from Cheney Lake should indicate evidence of reduced phosphorus levels in the conservation pool elevations relative to the conditions seen over 1975-1999.

Delivery Agents: The primary delivery agents for program participation will be the City of Wichita, conservation districts for programs of the State Conservation Commission and the Natural Resources Conservation Service. Producer outreach and awareness will be delivered by Kansas State Extension.

Reasonable Assurances:

Authorities: The following authorities may be used to direct activities in the watershed to reduce pollutants.

1. K.S.A. 65-171d empowers the Secretary of KDHE to prevent water pollution and to protect the beneficial uses of the waters of the state through required treatment of sewage and established water quality standards and to require permits by persons having a potential to discharge pollutants into the waters of the state.

2. K.S.A. 2-1915 empowers the State Conservation Commission to develop programs to assist the protection, conservation and management of soil and water resources in the state, including riparian areas.

3. K.S.A. 75-5657 empowers the State Conservation Commission to provide financial assistance for local project work plans developed to control nonpoint source pollution.

4. K.S.A. 82a-901, et seq. empowers the Kansas Water Office to develop a state water plan directing the protection and maintenance of surface water quality for the waters of the state.

5. K.S.A. 82a-951 creates the State Water Plan Fund to finance the implementation of the *Kansas Water Plan.*

6. The *Kansas Water Plan* and the Lower Arkansas Basin Plan provide the guidance to state agencies to coordinate programs intent on protecting water quality and to target those programs to geographic areas of the state for high priority in implementation.

Funding: The State Water Plan Fund annually generates $16-18 million and is the primary funding mechanism for implementing water quality protection and pollutant reduction activities in the state through the *Kansas Water Plan*. The state water planning process, overseen by the Kansas Water Office, coordinates and directs programs and funding toward watersheds and water resources of highest priority. Typically, the state allocates at least 50% of the fund to programs supporting water quality protection. This watershed and its TMDL are a High Priority consideration.

Effectiveness: Nutrient control has been proven effective through conservation tillage, contour farming and use of grass waterways and buffer strips. The key to success will be widespread utilization of conservation farming within the watersheds cited in this TMDL.

6. MONITORING

Additional data, to establish nutrient ratios, source loading and further determine mean summer lake trophic condition, would be of value prior to 2005. Further sampling and evaluation should occur once before 2005 and twice between 2005 and 2010.

7. FEEDBACK

Public Meetings: Public meetings to discuss TMDLs in the Lower Arkansas Basin were held March 9, 2000 and April 26-27, 2000 in Wichita, Hutchinson, Arkansas City and Medicine Lodge. An active Internet Web site was established at http://www.kdhe.state.ks.us/tmdl/ to convey information to the public on the general establishment of TMDLs and specific TMDLs for the Lower Arkansas Basin.

Public Hearing: A Public Hearing on the TMDLs of the Lower Arkansas Basin was held in Wichita on June 1, 2000.

Basin Advisory Committee: The Lower Arkansas Basin Advisory Committee met to discuss the TMDLs in the basin on September 27, November 8, 1999; January 13, 2000; March 9, 2000; and June 1, 2000.

Discussion with Interest Groups: Meetings to discuss TMDLs with interest groups include:

Sedgwick County Technical Advisory Group: August 8, October 14, and November 15, 1999 and January 20, April 27, and May 25, 2000.
Agriculture: January 12, February 2 and 29, 2000
Environmental: March 9, 2000
Conservation Districts: November 22, 1999
Industry: December 15, 1999, January 13, February 9 and 22, 2000
Local Environmental Protection Groups: September 30, November 2, December 16, 1999

Milestone Evaluation: In 2005, evaluation will be made as to the degree of implementation which has occurred within the watershed and current condition of Cheney Lake. Subsequent decisions will be made regarding the implementation approach and follow up of additional implementation in the watershed.

Consideration for 303d Delisting: The river will be evaluated for delisting under Section 303d, based on the monitoring data over the period 2005-2009. Therefore, the decision for delisting will come about in the preparation of the 2010 303d list. Should modifications be made to the applicable water quality criteria during the ten year implementation period, consideration for delisting, desired endpoints of this TMDL and implementation activities may be adjusted accordingly.

Incorporation into Continuing Planning Process, Water Quality Management Plan and the Kansas Water Planning Process: Under the current version of the Continuing Planning Process, the next anticipated revision will come in 2002 which will emphasize revision of the Water Quality Management Plan. At that time, incorporation of this TMDL will be made into both documents. Recommendations of this TMDL will be considered in *Kansas Water Plan* implementation decisions under the State Water Planning Process for Fiscal Years 2001-2005.

Approved September 11, 2000.